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(*Picicorvus Columbianus*), the Clay-colored Sparrow (*Spizella pallida*), and obtained a specimen of the long-tailed Chickadee (*Parus septentrionalis* var? *albescens* Baird). The Red Crossbill (*Curvirostra Americana*) and Pigmy Nut-hatch (*Sitta pygmæa*) were also common, with other species which scarcely ever leave the mountain forests. August 17th we encamped only three miles from the summit of Mullan's Pass, and nearly six thousand feet above the sea, where I observed a large Marmot (*Arctomys flaviventer*) and a Weasel (*Putorius longicauda?*). I also shot the first Oregon Grouse (*Bonasa Sabinii*), and saw MacGillivray's Warbler (*Geothlypis MacGillivrayi*).

THE LILIES OF THE FIELDS, OF THE ROCKS, AND OF THE CLOUDS.

BY PROF. G. HINRICHS.

"Consider the lilies of the field,—even Solomon in all his glory was not arrayed like one of these!"

THESE beautiful words and their promise are familiar to all of us; but we are perhaps less conversant with the beauty of form here referred to. The season of flowers is now with us; we have, therefor, each and all, abundant opportunity to consider or behold the plants in their own glory. A few words of explanation, and a few examples from the world of flowers may, perhaps, be an additional incentive to look upon the flowers themselves; and it may also prove interesting to show that there are objects deeply buried in the rocks, and also high up in the sky, which contain the same essential elements of beauty so much admired in the lilies of the field.

To the botanist the lilies comprehend a very large group of plants. A great number are distinguished for the brilliancy of their colors; as the numerous tulip-varieties and

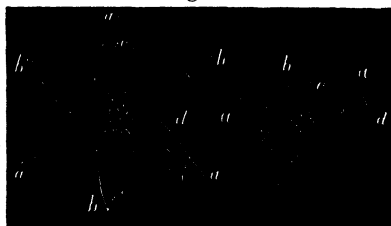
the lilies proper. The lily of the valley (Fig. 50) is of a pure white; hence its beauty cannot be sought in its color,

Fig. 50.



but must principally be due to its peculiar form. In the lily family the form of the flower is perfectly regular; the three leaves of the calyx are succeeded by three leaves of the corolla; then follow the six stamens, and in the centre of the flower we find the three pistils. These parts may be very easily recognized in the figure of the open flower and the bud of *Scilla* here added (Fig. 51).

Fig. 51.



In the Iris family—of which a section of the flower, bud and pod is illustrative—we notice also that the parts are all threefold; here, even the stamens are three in number, and not six as in the lilies. A like symmetry and regularity of flower is exhibited by many large trees, as the Date-palm (Fig. 52), the leaves

Fig. 52.

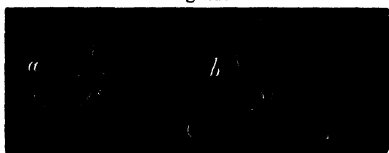


Fig. 53.



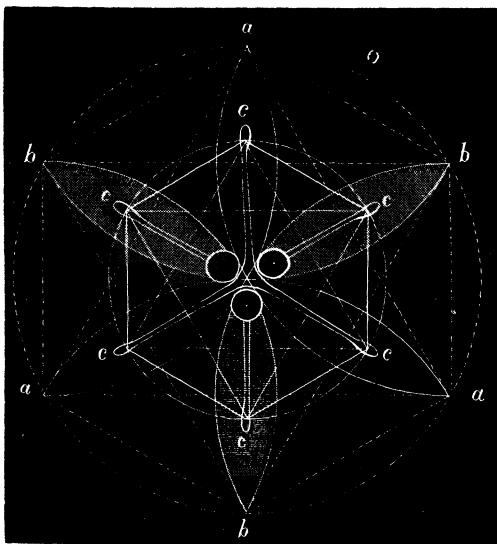
of which are the *Palms* of Scripture; and even microscopic parts of the flower, like the pollen grains, often show a similar regularity. (Fig. 53.)

That color cannot be the most important element of the beauty of these flowers, we may conclude from the fact that even the imperfect uncolored figures here given are not destitute of beauty. Again, the form of the petals is as changing as their color; so that the particular form of any of the parts of these flowers cannot either be considered as the most essential

element of their beauty. We conclude, then, that the form or *plan of the flower*, which is the same in all, is the element which above all others influences the beauty of these objects. This plan is here represented in a diagram (Fig. 54) wherein the leaves of the calyx are marked *a*; those of the corolla, *b*; the stamens, *c*; and the pistils, *d*.

Fig. 54.

In this diagram the perfect *regularity* of these flowers is more easily noticed than in the drawings of the different flowers themselves; for the diagram is the flower stripped of all its specific peculiarities superposed and ingrafted upon the general plan. We see from this dia-



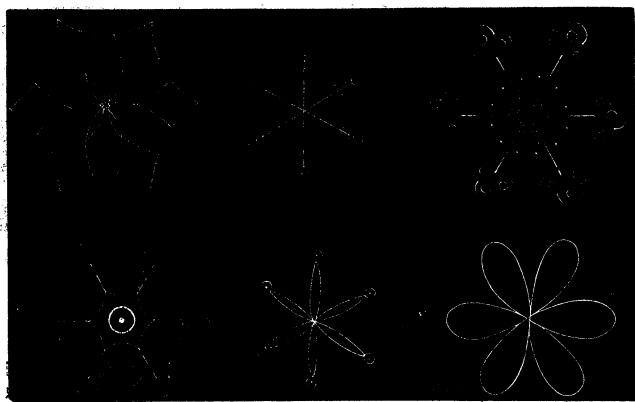
gram better still than from the figure of *Scilla*, that the calyx does not merely consist of three equal leaves, but that they are so placed around the axis, or stalk of the flower, that they, two and two, include the same angle between them, so as to produce a triangle (*a, a, a*), the sides of which are of equal length; such a triangle is called an *equilateral* one. The same is true in regard to the next series of three leaves, *b, b, b*, constituting the corolla of the flower; but not only do the calyx and the corolla form equilateral triangles but they are so placed that the leaves of the one fall exactly midways between those of the other. If the calyx be represented by a triangle, with its vertex upward, the corolla will be a triangle with the vertex downward. But both triangles, on account of this peculiar relative position, perfectly

harmonize with one another, so as to produce a new regular form embracing them both as simply equal halves; this more general form is the regular hexagon (six-sided figure), $a b, a b, a b$, in the diagram. The reality of this hexagon is in the lilies represented by the six equal stamens, c . Finally, inside of these we have the pistils, three in number, corresponding in position with the corolla.

The regular hexagon, or simpler the equilateral triangle, thus constitutes the foundation of the beauty of the lilies; the form of the petals and the shape of the other parts, as well as the colors, are merely accessories, capable of heightening the beauty of the flower, but not necessary to it.

The six figures of snow-crystals (Fig. 55), selected from about two hundred different forms observed by Mr. Franke,

Fig. 55.

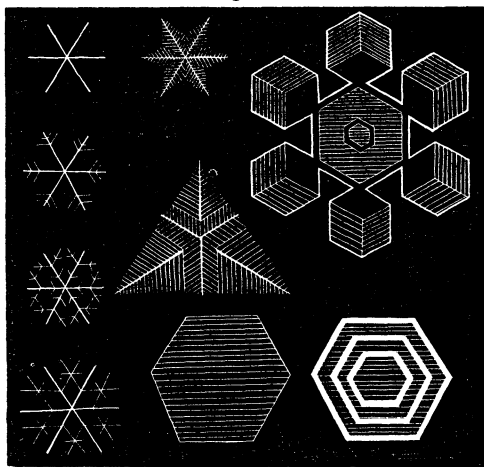


in Dresden, Saxony, in 1845-46, and published in the transactions of the society "Isis" of that city, show that the snow-crystal may rightly be termed the "lily of the sky." The first of the snow-crystals here given is almost identical with the hexagon, formed jointly by the calyx and corolla of many a lily of the field, while the second snow-crystal presents the same appearance as the six stamens of the lily. Just compare these snow-crystals with the figures of *Scilla* or the general diagram of the lily-flower!

The snow-crystals in the annexed figure (Fig. 56) are more common. Many of these forms may be observed on any calm winter day,

Fig. 56.

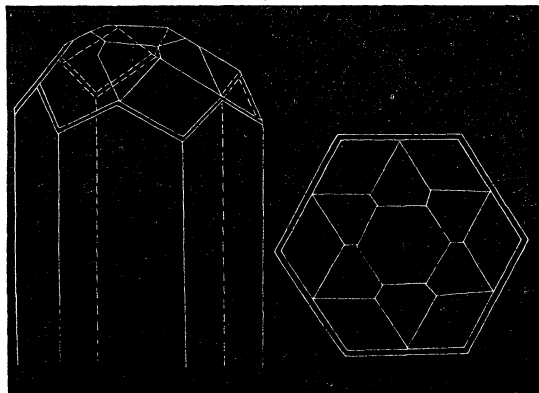
when the snow falls slowly in a cold atmosphere. The lower pennate form—also taken from the plates of Franke—is particularly interesting, for it shows the six-sided star as made up of two triangular halves, the one corresponding to the corolla, the other to



the calyx (outer star) of the lilies. In this same group of snow-crystals we have also three more compact forms, showing not merely the hexagonal star, principally represented by its six rays,

Fig. 57.

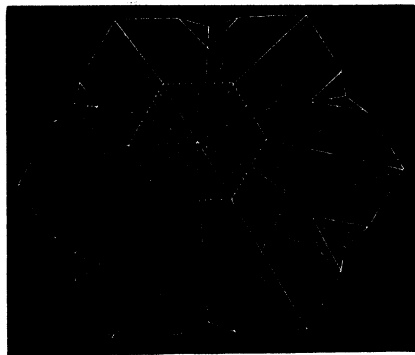
but having the whole ground more completely filled up so as to form a regular six-sided plate. Between these and the "lilies of the rocks," the crystals found in caves and crevices deep in the earth, there is no essential difference. Compare the figure of the Emerald (Fig. 57), particularly the lower figure representing a Russian emerald, as seen from



the lower figure representing a Russian emerald, as seen from

above, with the tabular snow-crystals just referred to! It exhibits first the regular hexagonal form in its outline, and also the two regular triangles corresponding as it were to the leaves of calyx and corolla in the lilies of the field! The emerald, therefore, is built upon the same fundamental plan on which the temple of beauty is erected in the lily; but the material, though beautiful, apparently did not admit of the graceful windings exhibited in the more yielding, but also less permanent body of the lily of the field. The emerald possesses all the beauty of form and color which can be ex-

Fig. 58.



pressed by uniformity of material; and if the lily of the field surpasses the emerald in graceful modification of these forms, and in variety of color, it lacks the lustre of the emerald, and even in this very variety carries the germ of speedy decay. There are many substances which in

their crystalline form exhibit the same trinity characteristic of the lily, the snow-star and the emerald. The well-known quartz, or rock-crystal, exhibits this form, and so does the beautiful mineral Alexandrite, represented in Fig. 58. This mineral was discovered in the Russian emerald diggings, on the very day on which the present emperor Alexander became of age. It has furthermore the remarkable peculiarity of appearing of a very beautiful green during the day, while in the evening (that is by lamp or gas-light) it appears of a pure red color; but red and green are the Russian colors. Hence the new mineral was named Alexandrite.

Even in the animal frame several structures have been discovered built upon the same principle, particularly the microscopic structure of the retina in the human eye. According to the discovery of the Danish microscopist, Dr.

Hannover, the interior of the eye is as if paved with very minute hexagonal blocks, put closely side by side. So also the plates covering many aquatic animals, particularly the body of many fossil crinoids, excellent figures of which may be found in the geological reports of the great American palæontologist, James Hall, of Albany. I add the figure of one plate from *Archæocidaris Agassizi*. (Fig. 59.)

Fig. 59.



It is evident from the few examples selected from among thousands, that the regular hexagonal form, or the division of the circle into three or six equal parts is a grand natural fact, alike manifest in the inorganic and organic world; this same fact is the glory and beauty of the lilies of the field, the lilies of the rocks, and the lilies of the sky.

So general a fact must be the consequence of a general law, and although this law may be deeply hidden in the mysteries of the vegetable and animal life exhibiting these forms, it may be more accessible in the lilies of inorganic, or so called inanimate nature. The question as to the cause of the form of the lily of the field may be premature, but may we not ask physical science for the cause of the form of the crystals of the rocks and of the sky? Or, to make the question still more precise, may we not ask the physicist, chemist and mineralogist—who each and every one are investigating these subjects—for the explanation of the wonderful form of the snow-crystal? That there is a cause for this form is manifest to every one who even merely glances at a few snow-crystals occasionally caught on our clothing on a winter's day; but as yet science has not been able to unravel the mysterious origin of the crystalline forms which adorn every nook and corner in the material world, and which we see forming under our very eyes in the laboratory of the chemist.

In my work called "Atomechanics, or Chemistry a Mechanics of the Panatoms," published in 1867, and distributed

among the scientific institutions at home and abroad, this question appears to be solved simply and completely. It is to be hoped that the intellectual inertia, always to be overcome by new and startling ideas, however plain and well founded, may not seriously retard the spreading of the answer to the question here raised: How is a snow-crystal built?

We cannot conclude this little sketch with more appropriate words than the description of the snow-crystal given by Prof. Tyndall, in his fourth lecture of the admirable work, "Heat as a mode of motion." The great philosopher of the Royal Institution says:

"Snow, perfectly formed, is not an irregular aggregate of ice-particles; in a calm atmosphere the aqueous atoms arrange themselves so as to form the most exquisite figures. [See the figures given in the preceding parts of this article.] The snow-crystals formed in a calm atmosphere are built upon the same type: the molecules arrange themselves to form hexagonal stars. From a central nucleus shoot six spiculæ, every two of which are separated by an angle of 60° . From these central ribs smaller spiculæ shoot right and left, with unerring fidelity to the angle 60° , and from these again other smaller ones diverge at the same angle. The six-leaved blossoms assume the most wonderful variety of form; their tracery is of the finest frozen gauze, and round about their corners other rosettes of smaller dimensions often cling. Beauty is superposed upon beauty, as if nature once committed to her task took delight in showing, even within the narrowest limits, the wealth of her resources."